User's Manual

SuperH™ Family E10A-USB Emulator

Additional Document for User's Manual

E10A-USB for SH7047F   HS7047KCU01HE

Renesas Microcomputer Development Environment System

SuperH™ Family / SH7040 Series

Supplementary Information on Using the SH7047F

Rev.1.00
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Keep safety first in your circuit designs!

Notes regarding these materials

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Section 1   Connecting the Emulator with the User System

1.1   Components of the Emulator

The E10A-USB emulator supports the SH7047F.

The supported operating modes are as follows:
— MCU expansion mode 2
— Single-chip mode

Note: When the SH7047F is used, set the FWP pin to 0 (low). To select MCU expansion mode 2, select the clock mode in FWP = 0 and MD3,2, and set MD1 = 1 and MD0 = 0. To select the single-chip mode, select the clock mode in FWP = 0 and MD3,2, and set MD1 = 1 and MD0 = 1.

Table 1.1 lists the components of the emulator.

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Table 1.1   Components of the Emulator

Classi-fication	Component	Appearance	Quan-tity	Remarks
Hard-ware	Emulator box		1	HS0005KCU01H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 72.9 g or HS0005KCU02H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 73.7 g
	User system interface cable		1	14-pin type: Length: 20 cm, Mass: 33.1 g
	User system interface cable		1	36-pin type: Length: 20 cm, Mass: 49.2 g (only for HS0005KCU02H)
	USB cable		1	Length: 150 cm, Mass: 50.6 g
Soft-ware	E10A-USB emulator setup program, SuperH™ Family E10A-USB Emulator User's Manual, Supplementary Information on Using the SH7047F*, and Test program manual for HS0005KCU01H and HS0005KCU02H		1	HS0005KCU01SR, HS0005KCU01HJ, HS0005KCU01HE, HS7047KCU01HJ, HS7047KCU01HE, HS0005TM01HJ, and HS0005TM01HE (provided on a CD-R)

Note: Additional document for the MCUs supported by the emulator is included. Check the target MCU and refer to its additional document.

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1.2 Connecting the E10A-USB Emulator with the User System

To connect the E10A-USB emulator (hereinafter referred to as the emulator), the H-UDI port connector must be installed on the user system to connect the user system interface cable. When designing the user system, refer to the recommended circuit between the H-UDI port connector and the MCU. In addition, read the E10A-USB emulator user's manual and hardware manual for the related device.

Table 1.2 shows the type number of the emulator, the corresponding connector type, and the use of AUD function.

Table 1.2 Type Number, AUD Function, and Connector Type

Type Number	Connector	AUD Function
HS0005KCU01H, HS0005KCU02H	14-pin connector	Not available
HS0005KCU02H	36-pin connector	Available

The H-UDI port connector has the 36-pin and 14-pin types as described below. Use them according to the purpose of the usage.

1. 36-pin type (with AUD function)
   The AUD trace function is supported. A large amount of trace information can be acquired in realtime. The window trace function is also supported for acquiring memory access in the specified range (memory access address or memory access data) by tracing.
2. 14-pin type (without AUD function)
   The AUD trace function cannot be used because only the H-UDI function is supported. For tracing, only the internal trace function is supported. Since the 14-pin type connector is smaller than the 36-pin type (1/2.5), the area where the connector is installed on the user system can be reduced.

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1.3 Installing the H-UDI Port Connector on the User System

Table 1.3 shows the recommended H-UDI port connectors for the emulator.

Table 1.3 Recommended H-UDI Port Connectors

Connector	Type Number	Manufacturer	Specifications
36-pin connector	DX10M-36S	Hirose Electric Co., Ltd.	Screw type
	DX10M-36SE, DX10G1M-36SE		Lock-pin type
14-pin connector	2514-6002	Minnesota Mining & Manufacturing Ltd.	14-pin straight type

Note: When designing the 14-pin connector layout on the user board, do not place any components within 3 mm of the H-UDI port connector. When designing the 36-pin connector layout on the user board, do not connect any components under the H-UDI connector.

1.4 Pin Assignments of the H-UDI Port Connector

Figures 1.1 and 1.2 show the pin assignments of the 36-pin and 14-pin H-UDI port connectors, respectively.

Note: Note that the pin number assignments of the H-UDI port connector shown on the following pages differ from those of the connector manufacturer.

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Pin No.	Signal	Input/Output [1]	SH7047F Pin No.	Note	Pin No.	Signal	Input/Output [1]	SH7047F Pin No.	Note
1	AUDCK	I/O	79		19	TMS	Input	59	
2	GND	——			20	GND	——		
3	AUDATA0	I/O	92		21 [2]	/TRST	Input	58	
4	GND	——			22 [5]	GND	——		
5	AUDATA1	I/O	90		23	TDI	Input	61	
6	GND	——			24	GND	——		
7	AUDATA2	I/O	88		25	TDO	Output	60	
8	GND	——			26	GND	——		
9	AUDATA3	I/O	86		27 [2]	/ASEBRKAK	Output	11	
10	GND	——			28	GND	——		
11 [2]	/AUDSYNC	I/O	78		29 [4]	UVCC	Output		
12	GND	——			30	GND	——		
13	AUDRST	Input	81		31 [2]	/RES	Output	87	User reset
14	GND	——			32	GND	——		
15	AUDMD	Input	80		33 [3]	GND	Output		
16	GND	——			34	GND	——		
17	TCK	Input	63		35	N.C.	——		
18	GND	——			36	GND	——		

Notes: 1. Input to or output from the user system.
2. The slash (/) means that the signal is active-low.
3. The emulator monitors the GND signal of the user system and detects whether or not the user system is connected.
4. If the VccQ pin is not connected to the UVCC, the I/O voltage of the user system interface will be fixed to 5.0 V.
5. The /DBGMD pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
(1) When the emulator is used: /DBGMD = 0 (ASE mode)
(2) When the emulator is not used: /DBGMD = 1 (normal mode)
To allow the /DBGMD pin to be GND by connecting the user system interface cable, connect pin 22 directly to the /DBGMD pin. Do not ground the pin.
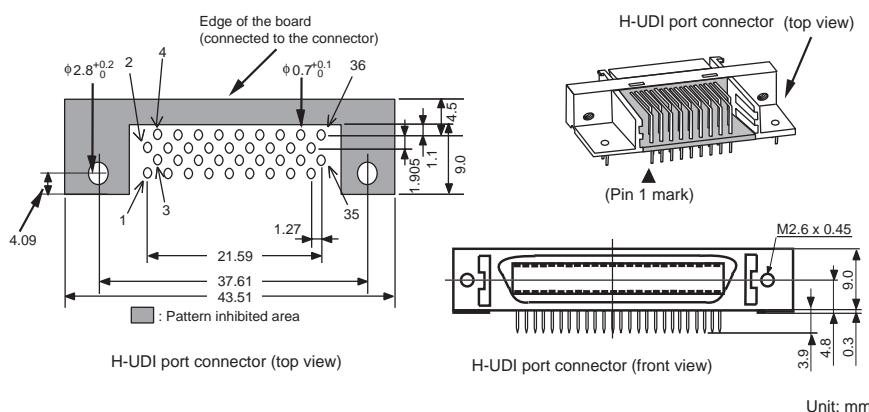
Figure 1.1 Pin Assignments of the H-UDI Port Connector (36 Pins)

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Pin No.	Signal	Input/Output[1]	SH7047F Pin No.
1	TCK	Input	63
2[2]	/TRST	Input	58
3	TDO	Output	60
4[2]	/ASEBRKAK	Output	11
5	TMS	Input	59
6	TDI	Input	61
7[2]	/RES	Output	87
8	N.C.		
9[5]	(GND)		
11[4]	UVCC	——	——
10, 12, and 13	GND	——	——
14[3]	GND	Output	——

Notes: 1. Input to or output from the user system.
2. The slash (/) means that the signal is active-low.
3. The emulator monitors the GND signal of the user system and detects whether or not the user system is connected.
4. If the VccQ pin is not connected to the UVCC, the I/O voltage of the user system interface will be fixed to 5.0 V.
5. The /DBGMD pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
(1) When the emulator is used: /DBGMD = 0 (ASE mode)
(2) When the emulator is not used: /DBGMD = 1 (normal mode)
To allow the /DBGMD pin to be GND by connecting the user system interface cable, connect pin 9 directly to the /DBGMD pin. Do not ground the pin.
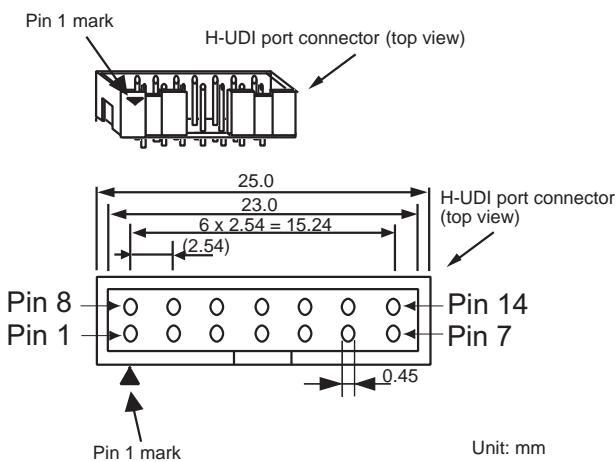

Figure 1.2   Pin Assignments of the H-UDI Port Connector (14 Pins)

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1.5 Recommended Circuit between the H-UDI Port Connector and the MCU

1.5.1 Recommended Circuit (36-Pin Type)

Figure 1.3 shows a recommended circuit for connection between the H-UDI and AUD port connectors (36 pins) and the MCU when the emulator is in use. Figure 1.4 shows a circuit for connection when UVCC is not connected.

Notes: 1. Do not connect anything to the N.C. pins of the H-UDI port connector.
2. The /DBGMD pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
(1) When the emulator is used: /DBGMD = 0 (ASE mode)
(2) When the emulator is not used: /DBGMD = 1 (normal mode)
Figures 1.3 and 1.4 show examples of circuits that allow the /DBGMD pin to be GND (0) whenever the emulator is connected by using the user system interface cable. When the /DBGMD pin is changed by switches, etc., ground pin 22. Do not connect this pin to the /DBGMD pin.
3. The FWP pin must be 0 (low) by switching jumper pins when the emulator is used.
4. When a network resistance is used for pull-up, it may be affected by a noise. Separate TCK from other resistances.
5. When the emulator is used, the AUDCK pin must be an end resistance (pulled up or down by a resistance of several kilo-ohms) because it may be affected by a reflected noise from the user system interface cable.
6. The pattern between the H-UDI port connector and the MCU must be as short as possible. Do not connect the signal lines to other components on the board.
7. When the power supply of the user system is turned off, supplying VccQ of the user system to the UVCC pin reduces the leakage current from the emulator to the user system. Buffers that can be activated by the internal power supply or user power supply (changed by the switch) are installed in the interface circuit of the emulator. If the user power is selected for supply to the UVCC pin, the buffers will not be activated unless supplied with user power. Thus no current flows from the user interface when the power supply of the user system is turned off. The I/O voltage level of the user system interface can be the same as that of the VccQ. To operate the emulator with low voltage (lower than 5.0 V), the VccQ must be supplied to the UVCC pin. Make the emulator's switch settings so that the VccQ will be supplied (SW2 = 1 and SW3 = 1) (as shown in figure 1.3).
8. The resistance values shown in figures 1.3 and 1.4 are recommended.
9. For the pin processing in cases where the emulator is not used, refer to the hardware manual of the related MCU.

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When the circuit is connected as shown in figure 1.3, the switches of the emulator are set as SW2 = 1 and SW3 = 1. For details, refer to section 3.8, Setting the DIP Switches, in the Debugger Part of the SuperH™ Family E10A-USB Emulator User's Manual.
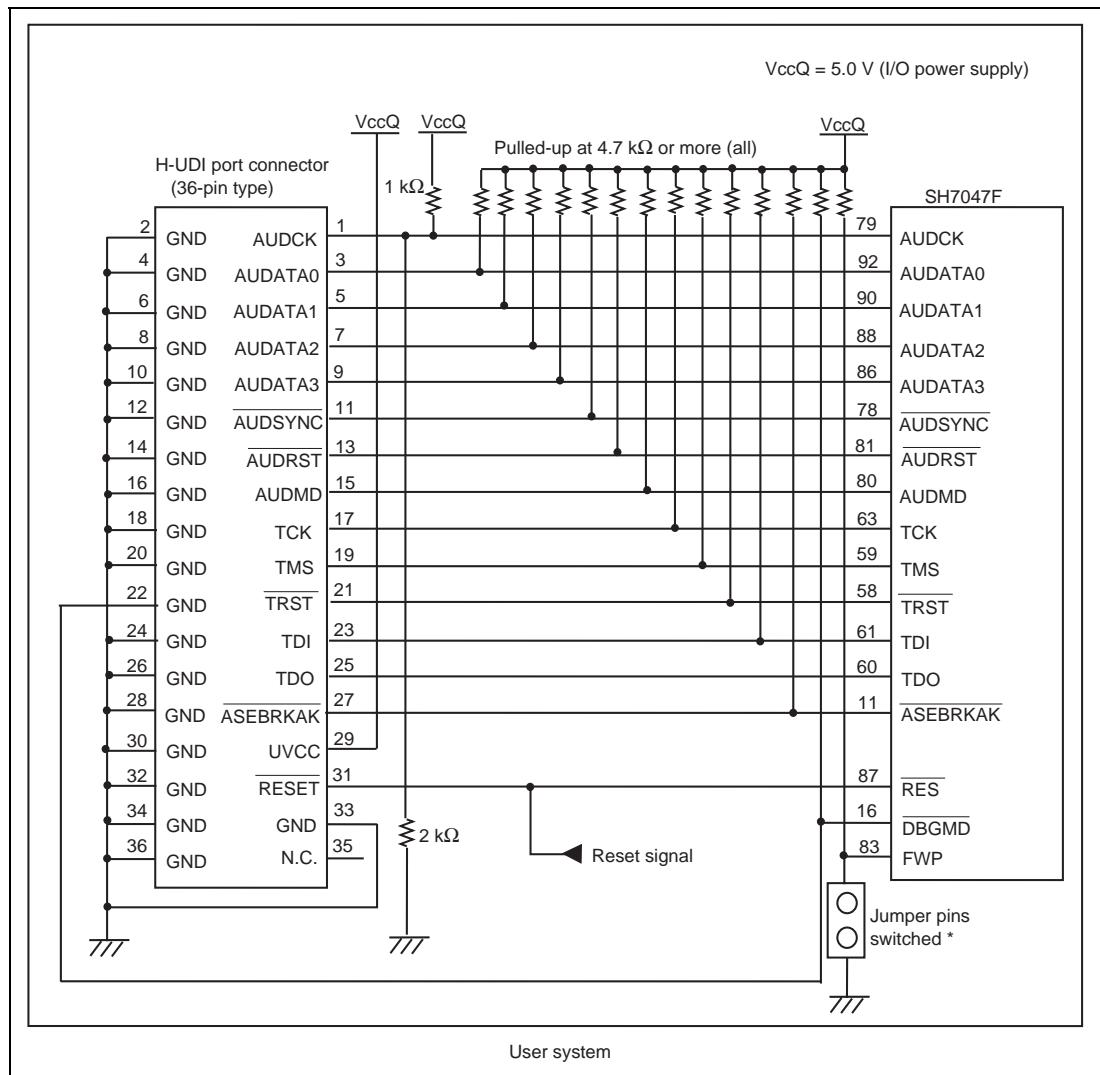
Figure 1.3   Recommended Circuit for Connection between the H-UDI Port Connector and MCU when the Emulator is in Use (36-Pin Type UVCC Connected)

Note: The FWP pin must be 0 (low) by switching jumper pins when the emulator is used.

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When the circuit is connected as shown in figure 1.4, the switches of the emulator are set as SW2 = 0 and SW3 = 1. For details, refer to section 3.8, Setting the DIP Switches, in the Debugger Part of the SuperH™ Family E10A-USB Emulator User's Manual.
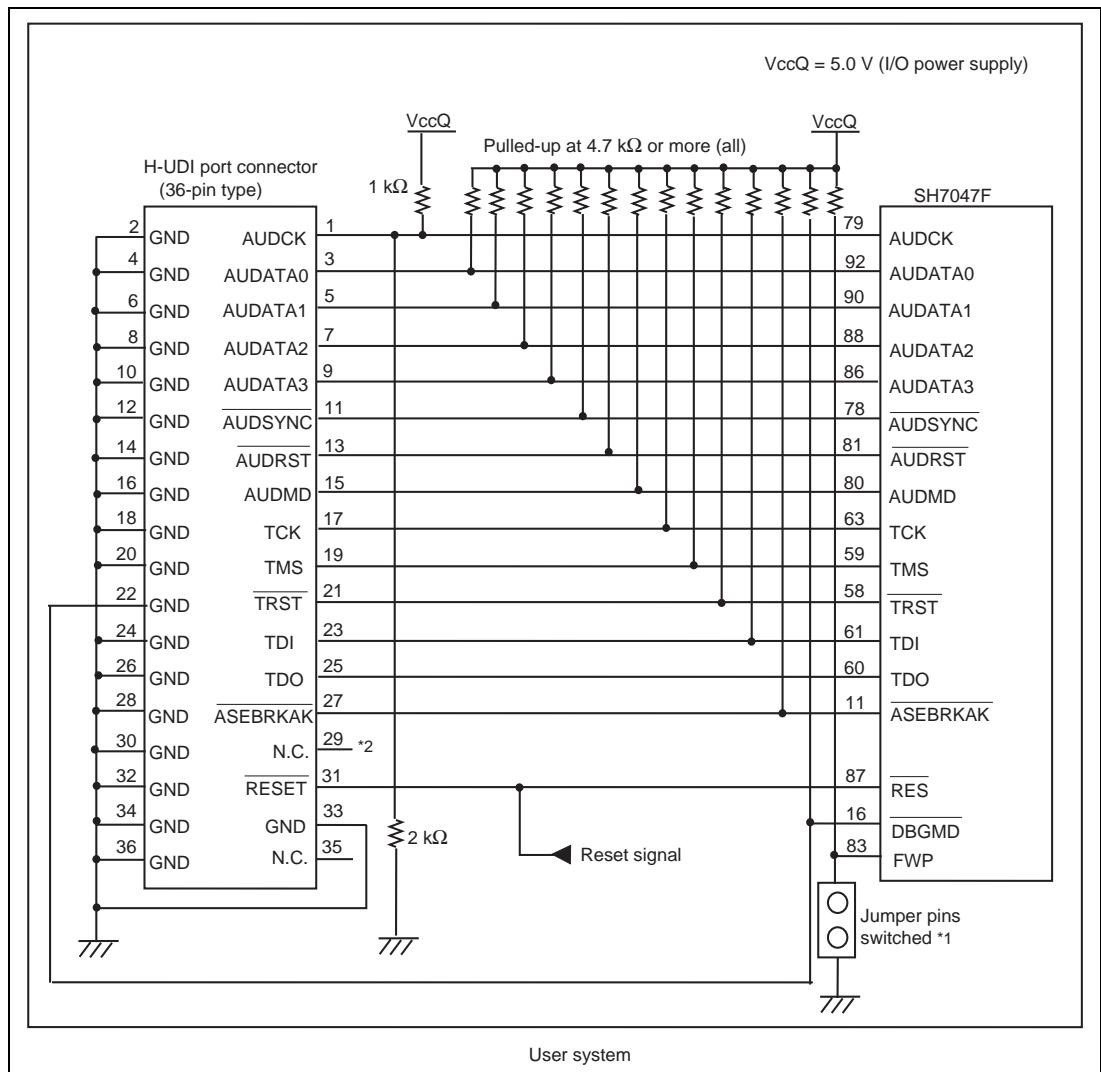
Figure 1.4   Circuit for Connection between the H-UDI Port Connector and MCU when the Emulator is in Use (36-Pin Type UVCC Not Connected[*2])

Notes: 1. The FWP pin must be 0 (low) by switching jumper pins when the emulator is used.
2. When UVCC is not connected and the user system is turned off, note that the leakage current flows from the emulator to the user system.

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1.5.2 Recommended Circuit (14-Pin Type)

Figure 1.5 shows a recommended circuit for connection between the H-UDI and AUD port connectors (14 pins) and the MCU when the emulator is in use. Figure 1.6 shows a circuit for connection when UVCC is not connected.

Notes: 1. Do not connect anything to the N.C. pins of the H-UDI port connector.

2. The /DBGMD pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
   (1) When the emulator is used: /DBGMD = 0 (ASE mode)
   (2) When the emulator is not used: /DBGMD = 1 (normal mode)
   Figures 1.5 and 1.6 show examples of circuits that allow the /DBGMD pin to be GND (0) whenever the emulator is connected by using the user system interface cable. When the /DBGMD pin is changed by switches, etc., ground pin 9. Do not connect this pin to the /DBGMD pin.

3. The FWP pin must be 0 (low) by switching jumper pins when the emulator is used.

4. When a network resistance is used for pull-up, it may be affected by a noise. Separate TCK from other resistances.

5. The pattern between the H-UDI port connector and the MCU must be as short as possible. Do not connect the signal lines to other components on the board.

6. When the power supply of the user system is turned off, supplying VccQ of the user system to the UVCC pin reduces the leakage current from the emulator to the user system. A level shifter that is activated by the internal power supply or user power supply (changed by the switch) is installed in the interface circuit of the emulator. If the user power is supplied to the UVCC pin, the level shifter is not activated as long as no user power is supplied. When the power supply of the user system is turned off, no current flows from the user interface. The I/O voltage level of the user system interface can be the same as that of the VccQ. To operate the emulator with low voltage (lower than 5.0 V), the VccQ must be supplied to the UVCC pin. Make the emulator's switch settings so that the VccQ will be supplied (SW2 = 1 and SW3 = 1) (as shown in figure 1.5).

7. The resistance values shown in figures 1.5 and 1.6 are recommended.

8. For the pin processing in cases where the emulator is not used, refer to the hardware manual of the related MCU.

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When the circuit is connected as shown in figure 1.5, the switches of the emulator are set as SW2 = 1 and SW3 = 1. For details, refer to section 3.8, Setting the DIP Switches, in the Debugger Part of the SuperH™ Family E10A-USB Emulator User's Manual.
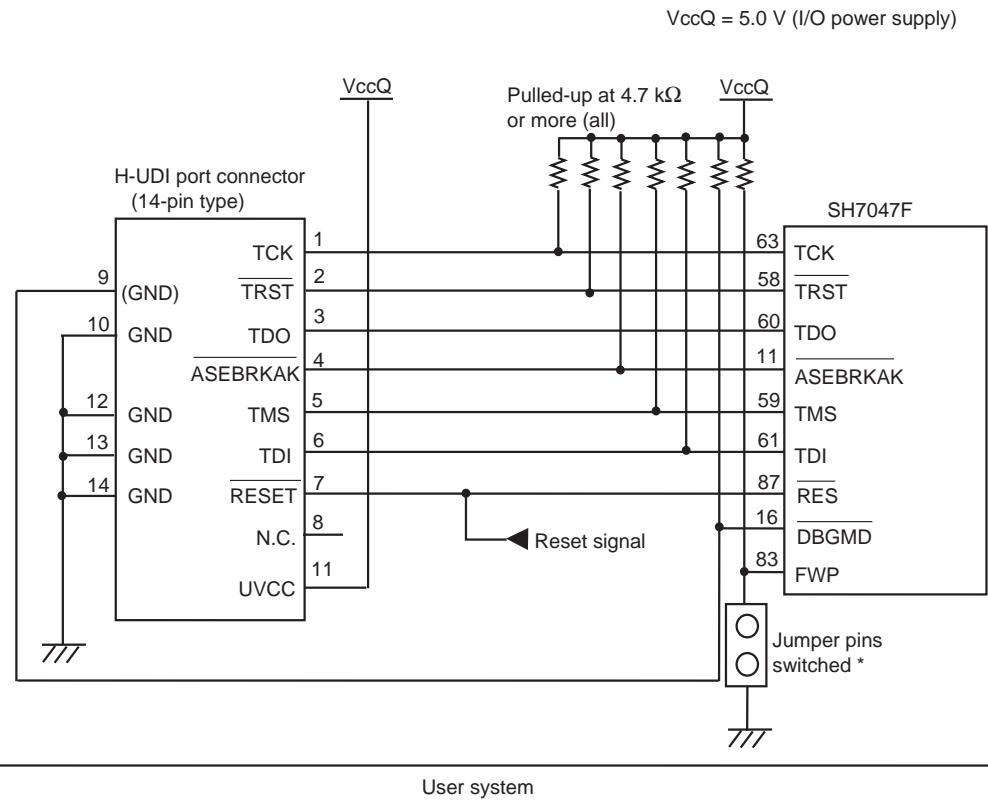

Figure 1.5 Recommended Circuit for Connection between the H-UDI Port Connector and MCU when the Emulator is in Use (14-Pin Type UVCC Connected)

Note: The FWP pin must be 0 (low) by switching jumper pins when the emulator is used.

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When the circuit is connected as shown in figure 1.6, the switches of the emulator are set as SW2 = 0 and SW3 = 1. For details, refer to section 3.8, Setting the DIP Switches, in the Debugger Part of the SuperH™ Family E10A-USB Emulator User's Manual.
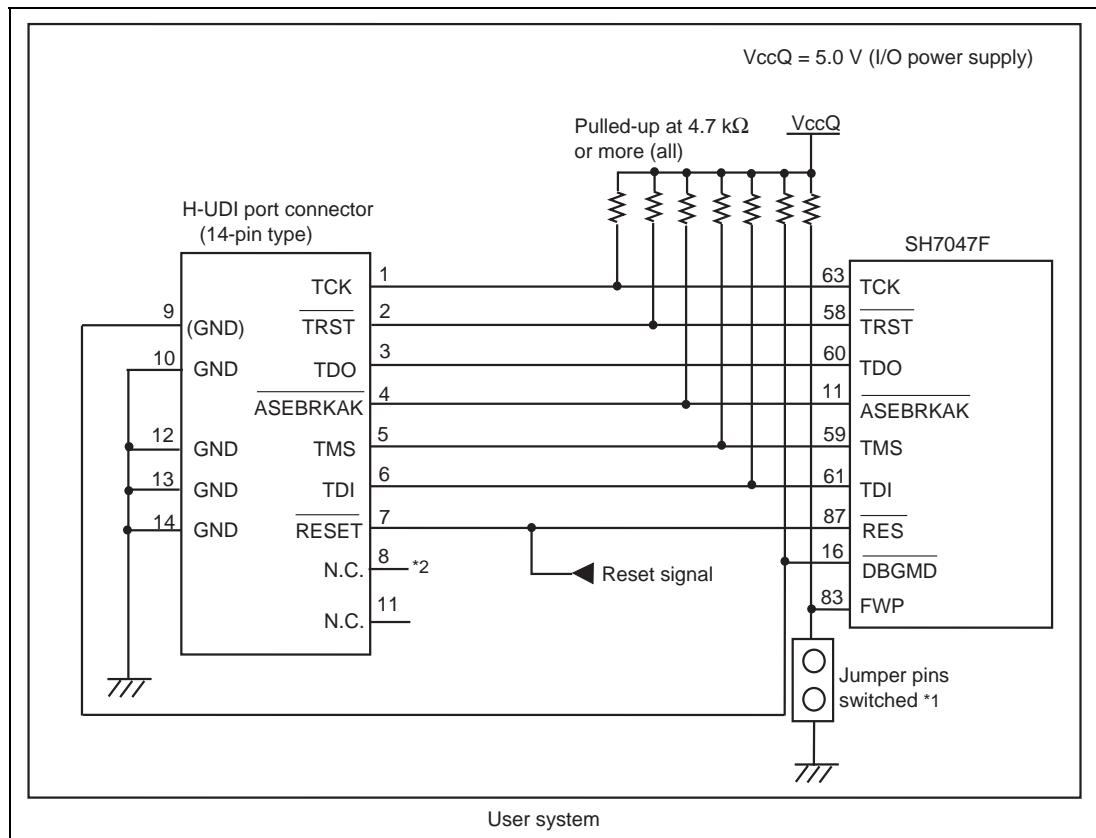
**Figure 1.6   Circuit for Connection between the H-UDI Port Connector and MCU when the Emulator is in Use (14-Pin Type UVCC Not Connected[*2])**

Notes: 1. The FWP pin must be 0 (low) by switching jumper pins when the emulator is used.
   2. When UVCC is not connected and the user system is turned off, note that the leakage current flows from the emulator to the user system.

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Section 2   Specifications of the Software when Using the SH7047F

2.1   Differences between the SH7047F and the Emulator

1. When the emulator system is initiated, it initializes the general registers and part of the control registers as shown in table 2.1. The initial values of the actual SH7047F registers are undefined. When the emulator is initiated from the workspace, a value to be entered is saved in a session.

Table 2.1   Register Initial Values at Emulator Link Up

Register	Emulator at Link Up
R0 to R14	H'00000000
R15 (SP)	Value of the SP in the vector address table
PC	Value of the PC in the vector address table
SR	H'000000F0
GBR	H'00000000
VBR	H'00000000
MACH	H'00000000
MACL	H'00000000
PR	H'00000000

2. The emulator uses the H-UDI; do not access the H-UDI.

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3. Low-Power States (Sleep, Software Standby, and Module Standby)

For low-power consumption, the SH7047F has sleep, software standby, and module standby states.

When the emulator is used, the sleep mode can be cleared with either the normal clearing function or with the forced break. Note that, however, if a command has been entered in software standby mode or module standby mode, no commands can be used from the emulator since the mode is cleared only with the normal clearing function.

Notes: The memory must not be accessed or modified in sleep state.

1. Do not set the MSTP2 or MSTP27 bit to 1 in the MSTCR2 register (address H'FFFF861E) nor the RAME bit to 0 in the SYSCR register (address H'FFFF8618), since doing so may prevent the emulator from operating correctly.

2. When the HS0005KCU02H is used, do not set the following bits to 0: the MSTP3 bit in the MSTCR2 register (address H'FFFF861E) and the AUDSRST bit in the SYSCR register (address H'FFFF8618). The AUD function cannot be used.

4. Reset Signals (/RES)

The RESET signal can be accepted during user program break, when the peripheral modules are reset. Since the PC, SR, and SP registers are not initialized, reset them and execute the GO command when the user program is executed from the reset vector.

Note: Do not break the user program when the RES, BREQ, and WAIT pins are being low. A TIMEOUT error will occur. The TIMEOUT error will also occur at memory access when the BREQ and WAIT pins are fixed low during break.

5. Data Transfer Controller (DTC)

The DTC operates even in the command wait state. When a data transfer request is generated, the DTC executes a DMA transfer.

6. Memory Access during User Program Execution

When a memory is accessed from the memory window, etc. during user program execution, the user program is resumed after it has stopped in the emulator to access the memory. Therefore, realtime emulation cannot be performed.

The stopping time of the user program is as follows:

Environment:
    Host computer: 650 MHz (Pentium® III)
    OS: Windows® 2000
    SH7047F: 40 MHz (CPU clock)
    JTAG clock: 10 MHz (TCK clock)

When a one-byte memory is read from the command-line window, the stopping time will be about 35 ms.

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7. Memory Access during User Program Break

Memory write operations are enabled for the RAM area and the internal flash memory. Therefore, an operation such as memory write or BREAKPOINT should be set only for the RAM area and the internal flash memory.

8. Multiplexed Functions

The AUD and H-UDI pins are multiplexed as shown in table 2.2. Those functions cannot be used when the emulator is used.

Table 2.2   Multiplexed Functions

Function 1	Function 2
PA15/CK/POE6/BACK	TRST (H-UDI)
PA14/RD/POE5	TMS (H-UDI)
PA13/POE4/BREQ	TDO (H-UDI)
PA12/WRL/UBCTRG	TDI (H-UDI)
PA10/CS0/RD/SCK2	TCK (H-UDI)
PD7/D7*	AUDSYNC (AUD)
PD6/D6*	AUDCK (AUD)
PD5/D5*	AUDMD (AUD)
PD4/D4*	AUDRST (AUD)
PD3/D3*	AUDATA3 (AUD)
PD2/D2/SCK2*	AUDATA2 (AUD)
PD1/D1/TXD2*	AUDATA1 (AUD)
PD0/D0/RXD2*	AUDATA0 (AUD)
PB5/IRQ3/POE3*	CK (AUD)

Note: Function 1 can be used when the AUD pins of the MCU are not connected to the emulator.

9. Loading Sessions

Information in [JTAG clock] of the [Configuration] dialog box cannot be recovered by loading sessions. Thus the TCK value will be 0.625 MHz.

10. [IO] Window

- Display and modification

  For each Watchdog Timer register, there are two registers to be separately used for write and read operations.

Table 2.3   Watchdog Timer Registers

Register Name	Usage	Register
TCSR (R)	Read	Watchdog timer control/status register
TCNT (R)	Read	Watchdog timer counter
RSTCSR (R)	Read	Reset control/status register
TCSR (W)	Write	Watchdog timer control/status register
TCNT (W)	Write	Watchdog timer counter
RSTCSR (W)	Write	Reset control/status register

- The internal I/O registers can be accessed from the [IO] window. After the I/O-register definition file is created, the MCU's specification may be changed. If each I/O register in the I/O-register definition file differs from addresses described in the hardware manual, change the I/O-register definition file according to the description in the hardware manual. The I/O-register definition file can be customized depending on its format. Note that, however, the emulator does not support the bit-field function.

- Verify

  In the [IO] window, the verify function of the input value is disabled.

11. Illegal Instructions

    If illegal instructions are executed by STEP-type commands, the emulator cannot go to the next program counter.

12. Interrupts

    All interrupts except for NMI are masked during user program break.

13. When accessing the reserved memory area, use the [Memory] window; do not use other windows.

14. Processing Time for Updating the Flash Memory Contents

    When the contents of the flash memory area is modified by the program loading, memory window, or memory command, or when a software break is set, a waiting time will be generated to write or read the flash memory before executing the user program.

    The processing time for updating the flash memory contents will be about a maximum of 60 seconds under the following environments (reference values):

    Host computer: 500 MHz (Pentium® III)
    SH7047F: 40 MHz (system clock frequency)

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2.2 Specific Functions for the Emulator when Using the SH7047F

The SH7047F does not support the following functions:

- MMU-related functions (The SH7047F does not mount the MMU.)
  — VPMAP-related command
  — Virtual and Physical specification in the [Configuration] window
  — Virtual and Physical specification on the command-line function
  — Virtual and Physical specification in the [Breakpoint] window
  — LDTLB instruction execution break function
  — MEMORYAREA_SET command
- Internal I/O access break function
- UBC_MODE command (The UBC function cannot be used while the emulator is being used.)
- UBC_MODE specification in the [Configuration] window or the command-line function
- Profiling function
- Performance measurement function

2.2.1 Break Condition Functions

The emulator can set conditions of Break Condition. Table 2.4 lists these conditions.

Table 2.4 Types of Break Conditions

Items	Description
Address bus condition (Address)	Breaks when the MCU address bus value or program counter value matches the specified value.
Data size condition (Size)	Breaks when the data size that has been accessed matches the specified value. Byte, word, or longword can be specified as the access data size.
Read or write condition (Read or Write)	Breaks in the read or write cycle.
Access type	Breaks when the bus cycle is the specified cycle.

Table 2.5 lists the combinations of conditions that can be set in the [Break Condition] dialog box.

Table 2.5 Conditions Set in the [Break Condition] Dialog Box

Dialog Box	Type	
	Address Bus Condition ([Address] page)	**Access Type Condition, Read or Write Condition, Data Size Condition ([Bus state] page)**
[Break Condition 1] dialog box	O	O
[Break Condition 2] dialog box	O	O
[Break Condition 3] dialog box	O	O
[Break Condition 4] dialog box	O	O
[Break Condition R] dialog box	O	-

Note: O: Can be set by clicking the radio button in the dialog box.

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Table 2.6 lists the combinations of conditions that can be set with the BREAKCONDITION_SET command.

Table 2.6   Conditions Set with the BREAKCONDITION_SET Command

Channel	Type Address Bus Condition (\<addropt\> option)	Access Type Condition (\<accessopt\> option), Read or Write Condition (\<r/wopt\> option), Data Size Condition (\<sizeopt\> option)
Break Condition 1	O	O
Break Condition 2	O	O
Break Condition 3	O	O
Break Condition 4	O	O
Break Condition R	O	-

Note: O: Can be set by the BREAKCONDITION_SET command.

Notes on Setting the [Break Condition] Dialog Box and BREAKCONDITION_SET Command:

1. When [Go to cursor], [Step In], [Step Over], or [Step Out] is selected, the settings of Break Condition 3 are disabled.
2. Break Condition 3 is disabled when an instruction to which a BREAKPOINT has been set is executed. Accordingly, do not set a BREAKPOINT to an instruction which satisfies Break Condition 3.
3. When a Break Condition is satisfied, emulation may stop after two or more instructions have been executed.
4. If a PC break before execution is set to the slot instruction after a delayed branch instruction, user program execution cannot be terminated before the slot instruction execution; execution stops before the branch destination instruction.

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2.2.2   AUD Functions

In the emulator, the functions listed in table 2.7 using the AUD function can be used. These functions are operational when the AUD pin is connected to the emulator.

To enable the AUD function, select [Options -> Emulator -> System…] or set [AUD used] in the [AUD Port] combo box of the [Configuration] dialog box that is opened by clicking the [Emulator System] toolbar button ().

Note: Select [AUD used] and set the following before using the AUD function in the user program. The AUD function does not operate correctly until the following is set after user program execution is started:

- Set 1 to the AUDSRST bit in the SYSCR register and cancel the AUD reset.
- Set the pin function controller to enable the AUD input/output pins (/AUDSYNC, AUDCK, AUDMD, /AUDRST, AUDATA3, AUDATA2, AUDATA1, and AUDATA0) and the CK pin.

Table 2.7   AUD Functions

Function	Description
Branch trace function	Displays the addresses and instruction words at the branch destination.
RAM monitor function	Enables realtime memory reading or writing during user program execution.

Notes: 1. When HS0005KCU01H is used, the AUD function cannot be used.
2. When the MCU operating mode is MCU expansion mode 2, the AUD function cannot be used.

(1) Branch Trace Function

When a branch occurs during user program execution, the branch destination address is acquired. When the next branch occurs while the trace information is being output, the information is stopped and the next trace information is output. The user program can be executed in realtime, but some trace information will not be output.

Note: After [Trace stop] is selected in [AUD mode] of the [Trace mode] page in the [Trace Acquisition] dialog box and the trace buffer of the emulator becomes full, the trace information is not acquired. The user program is continuously executed.

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(2) Realtime Memory Access Function

Realtime memory reading or writing is enabled during user program execution. The specified memory address contents (maximum three) can be displayed on the status bar. The memory contents can be changed by the command line, and can be referenced in the [Memory] window.

Memory can be read or written as follows:

1. When the [Memory] window is used:

   Memory can be read or written during user program execution. Open the address to be referenced in the [Memory] window. At reference, select Refresh from the [Memory] menu or issue the Refresh command in the command-line window.

2. When the command line is used:

   MEMORY_EDIT command: Memory can be read or written during user program execution.
   RAM_R command: Address and size displayed on the status bar are specified during user program execution.
   RAM_W command: Memory can be changed during user program execution. One command can change a maximum of three addresses.

Note: Note that the flash memory area cannot be written by the RAM_W command.

(3) Products Using the AUD Function and Note

Table 2.8   Type Number and AUD Function

Type Number	Connector	AUD Function
HS0005KCU01H, HS0005KCU02H	14-pin connector	Not available
HS0005KCU02H	36-pin connector	Available

Notes: 1. To use the AUD function, set the system clock to 40 MHz or lower.
        2. Trace cannot be acquired while memory read/write is being performed by using the RAM monitor function during user program execution.

2.2.3 Notes on Displaying the [Trace] Window

1. The AUD trace outputs the differences between newly output branch destination addresses and the previously output branch destination addresses. If the previous branch destination address is the same as the upper 16 bits, the lower 16 bits are output. If it matches the upper 24 bits, the lower 8 bits are output. If it matches the upper 28 bits, the lower 4 bits are output. The emulator regenerates the 32-bit address from these differences and usually displays it in the [Trace] window. If the emulator cannot display the 32-bit address, it displays the difference from the previously displayed 32-bit address.

2. When a completion-type exception occurs during exception branch acquisition, the next address to the address in which an exception occurs is acquired.

3. When the [Halt] option is used from the popup menu in the [Trace] window, realtime emulation is retained.

4. In the emulator, the maximum number of trace display pointers is 65535 lines (32767 branches).
   However, the maximum number of trace display pointers differs according to the AUD trace information to be output. Therefore, the above pointers cannot be always acquired.

5. When only one line is acquired by trace, the display data is not updated. In this case, open the [Trace] window again.

2.2.4 Notes on Using the JTAG Clock (TCK)

1. When the JTAG clock (TCK) is used, set the frequency to lower than that of the system clock.
2. Do not set 20 MHz for the JTAG clock (TCK).

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2.2.5   Notes on Setting the [Breakpoint] Dialog Box

1. When an odd address is set, the address is rounded down to an even address.
2. A BREAKPOINT is accomplished by replacing instructions. Accordingly, it can be set only to the RAM area and the internal flash memory. However, a BREAKPOINT cannot be set to the following addresses:
   — An area other than the CS0, internal RAM, and internal flash memory areas
   — An instruction in which Break Condition 3 is satisfied
   — A slot instruction of a delayed branch instruction
3. During step execution, BREAKPOINTs are disabled.
4. Break Condition 3 is disabled when an instruction to which a BREAKPOINT has been set is executed. Accordingly, do not set a BREAKPOINT to an instruction which satisfies Break Condition 3.
5. When execution resumes from the address where a BREAKPOINT is specified, single-step operation is performed at the address before execution resumes. Therefore, realtime operation cannot be performed.
6. When a BREAKPOINT is set to the slot instruction of a delayed branch instruction, the PC value becomes an illegal value. Accordingly, do not set a BREAKPOINT to the slot instruction of a delayed branch instruction.
7. If an address of a BREAKPOINT cannot be correctly set in the ROM or flash memory area, a mark ● will be displayed in the [BP] area of the address on the [Editor] or [Disassembly] window by refreshing the [Memory] window, etc. after Go execution. However, no break will occur at this address. When the program halts with the break condition, the mark ● disappears.

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Additional Document for User's Manual
Supplementary Information on Using the SH7047F

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